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NWL Report No. 1841

TERRIER STRUCTURAL FIRING TEST ABOARD THE ITALIAN CRUISER GIUSEPPE GARIBALDI (C-551)

by

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DAHLGREN, VIRGINIA

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U. S. Naval Weapons Laboratory
Dahlgren, Virginia

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Task Assignment
GTE-MAP-001/210-8/W015BO-006

25 January 1963

CONTENTS

ABSTRACT

Four TERRIER Mk 12 Mod 0 boosters with concrete slugs were fired aboard the Italian cruiser GIUSEPPE GARIBALDI (C-551) to investigate the adequacy of the protection for the TERRIER launching system personnel against blast effects and to determine the effects of the booster blast on the ship's structure. The test vehicles were fired at various angles such that the exhaust stream was directed at areas thought to impose the most severe conditions on the ship's structural components and equipment. Measurements were made of toxic gas concentrations, sound pressure levels, flame penetrations at door and port seals, and temperature changes inside the ship and in the blast area of the II TUGA Deck (02 level) and the I TUGA Deck (01 level). High-speed motion pictures were taken on all tests.

The results indicated excessive smoke and gas leakage through the Port Blast Door, gas leakage through the ventilation intake system (II TUGA), and minor structural damage to equipment mounted on the side of the II TUGA deckhouse.

FOREWORD

This is the final report of the TERRIER structural firing tests aboard the Italian cruiser GIUSEPPE GARIBALDI (C-551) conducted under BUWEPS Task Assignment GTE-MAP-001/210-8/W015B0-006 of 4 May 1962 in accordance with reference (a). The firing tests were conducted to determine the effects of the TERRIER booster blast on the ship's structure and to evaluate the adequacy of protection for the TERRIER launching system personnel against blast effects.

The preliminary results of these tests were reported in reference (b).

This report was reviewed by the following members of the Weapons Development and Evaluation Laboratory:

J. J. WALSH, Head, Physical Projects Section
D. C. ROSS, Head, Experimental Branch
H. R. PRYOR, Head, Development Division
R. J. NEY, Captain USN, Assistant Director for Military Applications
D. W. STONER, Director

APPROVED FOR RELEASE:

/s/ R. H. LYDDANE
Technical Director

INTRODUCTION

Structural firing tests were conducted aboard the Italian cruiser GIUSEPPE GARIBALDI (C-551) to establish the adequacy of the ship's structure to withstand the booster blast and to test for safe habitability of manned areas during missile firings. These tests were accomplished by firing four TERRIER Blast Test Vehicles (BTV), each composed of a Mk 12 Mod 0 booster with concrete slug, at various angles such that the exhaust stream was directed at areas thought to impose the most severe conditions on the ship's structural components and equipment. These firings served also to determine the adequacy of the door seals, ports, and equipment exposed to the blast. Detailed test objectives are given in the test plan, reference (a), and a brief summary of test objectives and conditions is presented in Appendix D.

Instrumentation was provided for measuring toxic gas concentrations, sound pressure levels, and temperature changes, for observing the extent of flame entrance at door seals and ports, and for providing high-speed photographic coverage. The instrumentation was moved for each test in order to make all measurements in the same configuration with respect to the impingement areas. The detailed test results are grouped according to type of measurement rather than by test to avoid repeated references to the kind of measurement considered.

TEST PROCEDURE

The instrumentation was installed and operated by NWL, Dahlgren, personnel with the assistance of members of the ship's company assigned to the various instrumentation groups. The equipment used to record sound pressures and temperature was housed in the Forward Director Barbette. Signal cables were connected between the instrumentation housing and the transducers located throughout the after part of the ship in the areas under test. For each test, a TERRIER Mk 12 Mod 0 booster with concrete slug was launched from either the "A" rail or "B" rail of the Mk 5 Mod 0 guided-missile launcher.

The launcher angles, impingement areas, and the sequence in which the tests were conducted are tabulated below:

Test No.	Date	Launcher			Impingement Area
		Rail	Train	Elevation	
1	10-5-62	A	73°00'	65°00'	Port Blast Door.
2	10-5-62	A	115°00'	43°20'	Dud Jettisoning System, Portside.
3	10-5-62	A	335°00'	13°00'	II TUGA Deck, Frame 34, Starboard.
4	10-5-62	B	198°00'	06°35'	Starboard Edge of II TUGA Deckhouse at Frame 62.

The tests were conducted as part of the services contracted by the Italian Navy with BUWEPS and were fired in the Virginia Capes Operating area.

After each test, a description of the damage was recorded and the damaged areas were photographed. The test data were returned to NWL, Dahlgren, for detailed analysis and reporting.

The procedures followed by the different groups in obtaining each type of measurement or observation are described in the following paragraphs:

1. Camera Coverage

Camera coverage was arranged to provide information on structural damage, for observing the extent of flame entrance at door and hatch seals, and to document the other test instrumentation on all tests. Details for each camera, including its location, type, speed, and coverage are included in Table 1.

2. Sound Pressure Measurements

Measurements of sound pressure level (SPL) in the areas adjacent to the missile launcher were made to provide information on the high intensity sound levels generated by the firings of the TERRIER booster. The microphones were located for each test as shown in Figure 1 and identified by Table 2. Details of test equipment and procedures are included in Appendix C.

3. Temperature Measurements

The air temperature was monitored in the missile house in the areas that would be manned during missile launchings, to record any change in temperature attributable to the firing of the boosters. The areas in which the temperatures were measured are indicated in Table 3. Details of the test equipment and procedures are included in Appendix C.

4. Toxic Gas Sampling

Shipboard toxicity tests were conducted to determine the presence and the concentrations of noxious gas leakage into the interior of the ship. Among the expected products of combustion were carbon monoxide, lead, and oxides of nitrogen. Details of test equipment and procedures are included in Appendix C.

RESULTS AND DISCUSSION

The structural firing tests were successfully conducted on 5 October 1962. Instrumentation functioned satisfactorily during all firings except for Test 1, during which there was a loss of electrical power resulting in the shut-down of the electrically operated movie camera and gas sampling equipment. The data collected and the observations made during and after the tests indicated excessive gas and smoke leakage through the Port Blast Door, gas leakage through the ventilation intake system (II TUGA), and minor structural damage to equipment mounted on the II TUGA deckhouse. A detailed discussion of each kind of measurement and of the damage incurred is included in the following paragraphs:

1. Sound Pressure Levels

A spectrum analysis of each noise recording was made using a Bruel and Kjaer spectrum analyzer. The output signals from the magnetic tapes were applied successively to each filter of the 1/3 octave spectrum analyzer and a complete time history for each filter was plotted using a high-speed signal level recorder. The maximum sound pressure level was derived from each time history curve and the results for each test are listed in Tables 4 through 14. The maximum (over-all) sound pressure level for each test was obtained from the time history plot of the Linear "C" Network of the Bruel and Kjaer sound equipment. A summary of these measurements is contained in Table 2. All sound pressure level measurements were furnished to the Bureau of Medicine and Surgery for an evaluation of health hazards to operating personnel.

2. Temperature Measurements

The maximum temperature rise recorded inside the ship was 317.0°F above an ambient temperature of 86.0°F. This temperature rise occurred in the area of P-6 beneath the Port Blast Door. The temperature-time curve for this area is shown in Figure 2. The temperatures recorded during the tests are included in Table 3.

3. Toxic Gas Sampling

The analysis of the air samples collected during the conduct of these tests indicated excessive smoke and gas leakage into the ship during two of the firings. The high concentration of carbon monoxide present in the missile house after Test 1 was attributed to exhaust gases entering through the Port Blast Door (Figure 3 shows the opening in the Port Blast Door). The concentration of lead present after Test 4 was the result of hot exhaust gases entering through the ventilation intake system on the II TUGA Deck (02 level). Details concerning the kind and number of samples, areas checked, access and sampling time, and the concentration of gases are included in Table 15. Information concerning toxic gases in this report was furnished to the Bureau of Medicine and Surgery for evaluation of the hazards to personnel.

4. Structural Damage

There was no major structural damage observed during or after firing of the four Mk 12 Mod 0 boosters. The minor structural damage incurred is as follows:

a. The lamp globe and lamp mounted on the starboard side of II TUGA deckhouse were broken (Figure 4).

b. The fire hose located on the starboard side of the II TUGA deckhouse was charred (Figure 4).

c. The fire fighting gear mounted on the side of the II TUGA deckhouse was blown to the Coperta (main deck) (Figure 4).

d. The radome of the main antenna of the AN/SPG-55 Missile Director was punctured. The puncture was approximately six inches long and one inch wide (Figure 5).

e. The armor shielding was completely burned off the ship service telephone cable located at the forward base of the launcher.

f. The ammunition loading gear cover located on the II TUGA deck, Frame 35, starboard, was blown away (Figure 6).

The Port Blast Door was blown open an undetermined distance by the booster blast during Test 1. After the blast subsided, an opening of approximately one inch remained in the Port Blast Door. An initial investigation of the blast door and the tension-type door latching mechanism by the Northern Ordnance representative showed no malfunction in the operation of the door or the latching mechanism. Further investigation, however, revealed that the tension in the door latching mechanism was that normally set to prevent opening of the door by the exhaust of the less powerful TERRIER Mk 7 Mod 0 Booster.

CONCLUSIONS

It is concluded that the damage caused by the blast of the TERRIER Mk 12 Mod 0 booster during the structural firing tests was minor. It appears that a redesign of the blast doors latching mechanisms, the closing of the intake vents in the vicinity of the missile launcher, and the relocation of auxiliary equipment would eliminate most of the items susceptible to damage and gas leakage during missile firings.

RECOMMENDATIONS

It is recommended that:

1. The latching mechanisms on the blast doors be redesigned to prevent the opening of the doors by the exhaust of the TERRIER Mk 12 Mod 0 booster.

2. The cable leading to the ship service phone be placed in a conduit.

3. The shutters on the ventilation intake vents in the blast area be closed during missile firings to prevent the booster exhaust from entering the ship through the ventilation system.

4. All of the auxiliary equipment mounted on the side of the II TUGA deckhouse be relocated to a more protected area.

REFERENCES

(a) NWL, Dahlgren, ltr WDEP:PPW:efl 8800/TE/S of 30 July 1962
(b) NWL, Dahlgren, ltr WDEP:PPW:efl 8800/TE/S of 5 November 1962

APPENDIX A

TABLE 1

CAMERA COVERAGE

Test No.	Camera	Location	Speed frames/sec	Focal Length of Lens	Coverage
1	16mm Vought	Wing and Fin Assembly Area	200	10mm	Port Blast Door
	16mm Benson-Lehner	Top of II TUGA Deckhouse	400	25mm	Launcher Area
2	16mm Benson-Lehner	Top of II TUGA Deckhouse	400	25mm	Launcher Area
3	16mm Benson-Lehner	Coperta, Frame 18	400	25mm	Frame 34 II TUGA Deck
4	16mm Vought	Telemetering Ground Station	200	10mm	Safety Observer's Port
	16mm Benson-Lehner	II TUGA Deck, Starboard	400	25mm	Impingement Area

TABLE 2

SUMMARY OF NOISE LEVEL MEASUREMENTS

Round No.	Location	No. in Figure 1	Ambient SPL(1) (db)	Maximum SPL(2) (db)	Duration of Booster Noise(3) (sec)	Base Line (db)
1	Observer Port	1	85	146	1.76	110
	Checkout Area	2	68	133	0.31	110
	P-6	3	82	143	1.03	110
	P-9	4	82	127	0.86	110
2	Observer Port	1	85	135	1.75	110
	Checkout Area	2	68	122	1.03	110
	P-6	3	82	126	0.88	115
	P-9	4	82	128	1.60	110
3	Observer Port	1	85	*	--	--
	Checkout Area	2	68	122	1.03	110
	P-6	3	82	*	--	--
	P-9	4	82	*	--	--
4	Observer Port	1	85	131	1.40	110
	Ward Room	5	65	*	--	--
	P-6	3	82	135	1.00	115
	Radar Room DB-102-85-P6	6	70	*	--	--

*Less than 100 db

(1)Sound Pressure Level Re 0.0002 dynes/cm^2 (Ambient SPL measured with sound level meter).

(2)Over-all value obtained from Linear "C" Network of the spectrum analyzer.

(3)Time from first indication of booster noise until decay of booster noise to a level designated as "Base Line".

TABLE 3

AIR TEMPERATURE MEASUREMENTS IN MANNED AREAS

Test No.	Location	Temperature Before Firing (°F)	Maximum Temperature (°F)	Temperature Rise (°F)
1	Beneath Port Blast Door	86.0	403.0	317.0
	P-2 Panel Missile House	87.0	93.0	6.0
2	Beneath Port Blast Door	95.0	100.0	5.0
	P-2 Panel Missile House	91.0	95.0	4.0
3	Missile Checkout Area	80.0	87.0	7.0

TABLE 4 ROUND NO. 1

SPECTRUM ANALYSIS OF NOISE AT OBSERVER PORT

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	128
50	127
63	124
80	129
100	129
125	130
160	129
200	137
250	131
315	130
400	133
500	130
630	127
800	130
1000	131
1250	132
1600	132
2000	131
2500	134
3150	132
4000	134
5000	134
6300	132
8000	126
10000	129

TABLE 5 ROUND NO. 1

SPECTRUM ANALYSIS OF NOISE AT CHECKOUT AREA

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	102
50	102
63	100
80	102
100	< 100
125	< 100
160	103
200	106
250	105
315	109
400	110
500	113
630	110
800	113
1000	114
1250	116
1600	118
2000	118
2500	118
3150	115
4000	116
5000	113
6300	112
8000	108
10000	108

TABLE 6 ROUND NO. 1

SPECTRUM ANALYSIS OF NOISE AT P-6

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	107
50	108
63	108
80	111
100	117
125	118
160	115
200	117
250	119
315	119
400	122
500	122
630	124
800	125
1000	123
1250	123
1600	127
2000	126
2500	129
3150	130
4000	133
5000	133
6300	132
8000	127
10000	132

TABLE 7 ROUND NO. 1

SPECTRUM ANALYSIS OF NOISE AT P-9

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	106
50	100
63	<100
80	106
100	<100
125	105
160	106
200	<100
250	105
315	104
400	106
500	110
630	112
800	114
1000	114
1250	114
1600	117
2000	116
2500	119
3150	117
4000	116
5000	115
6300	112
8000	108
10000	110

TABLE 9 ROUND NO. 2

SPECTRUM ANALYSIS OF NOISE AT CHECKOUT AREA

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	113
50	106
63	106
80	112
100	110
125	109
160	108
200	$\leq$ 100
250	108
315	106
400	103
500	103
630	103
800	100
1000	102
1250	102
1600	104
2000	103
2500	104
3150	105
4000	103
5000	100
6300	$\leq$ 100
8000	$<$ 100
10000	$<$ 100

TABLE 10 ROUND NO. 2

SPECTRUM ANALYSIS OF NOISE AT P-6

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	109
50	111
63	109
80	112
100	112
125	114
160	116
200	114
250	113
315	112
400	113
500	112
630	113
800	110
1000	106
1250	109
1600	108
2000	108
2500	109
3150	109
4000	107
5000	103
6300	<100
8000	<100
10000	<100

TABLE 12 ROUND NO. 3

SPECTRUM ANALYSIS OF NOISE OF CHECKOUT AREA

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	107
50	104
63	106
80	109
100	106
125	110
160	111
200	113
250	110
315	109
400	107
500	104
630	102
800	104
1000	104
1250	104
1600	103
2000	102
2500	< 100
3150	< 100
4000	< 100
5000	< 100
6300	< 100
8000	< 100
10000	< 100

TABLE 13 ROUND NO. 4

SPECTRUM ANALYSIS OF NOISE AT OBSERVER PORT

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	117
50	114
63	116
80	111
100	114
125	117
160	110
200	109
250	112
315	114
400	112
500	116
630	113
800	113
1000	113
1250	112
1600	114
2000	117
2500	120
3150	121
4000	120
5000	119
6300	117
8000	108
10000	107

TABLE 14 ROUND NO. 4

SPECTRUM ANALYSIS OF NOISE AT P-6

Center Frequency of 1/3 Octave Band Pass Filter (cps)	Maximum Sound Pressure Level (db) Re 0.0002 dynes/cm^2
40	125
50	122
63	121
80	118
100	119
125	117
160	117
200	115
250	119
315	114
400	112
500	114
630	111
800	110
1000	105
1250	104
1600	106
2000	104
2500	102
3150	102
4000	103
5000	<100
6300	<100
8000	<100
10000	≤ 100

TABLE 15

RESULTS OF GAS TESTS AND SMOKE OBSERVATION

Round No.	Type of Sample	No. of Samples	Sampling Area	Access or Sampling Time	Concentration	Remarks
1	Carbon Monoxide	1	Missile House P-6 Panel.	X+1 Min.	400 ppm	Smoke in area; blast doors opened to allow outside air to enter at X+22 Min.
		10	Missile House P-6 Panel.	X to X+22 Min.	150 ppm Average Sample	
		1	Missile House P-6 Panel.	X+22 Min.	100 ppm	
	*Lead	3	Missile House All Locations.	--	--	Power Failure.
	Oxide of Nitrogen	1	Missile House P-6 Panel.	X to X+2.5 Min.	None	
2	Carbon Monoxide	1	Missile House P-2 Panel.	X to X+2.5 Min.	Less than 10 ppm	
		3	Missile House P-6 Panel.	X to X+2.5 Min.	Less than 10 ppm	
		1	Missile House P-9 Panel.	X to X+2.5 Min.	Less than 10 ppm	
	*Lead	1	Missile House P-2 Panel.	X to X+5 Min.	.000 Mg/m^3	
		1	Missile House P-6 Panel.	X to X+5 Min.	.000 Mg/m^3	
		1	Missile House P-9 Panel.	X to X+5 Min.	.000 Mg/m^3	
	**Lead	1	Missile House P-6 Panel.	X to X+2.5 Min.	.014 Mg/m^3	
		1	Missile House P-9 Panel.	X to X+2.5 Min.	.015 Mg/m^3	
	Oxide of Nitrogen	1	Missile House P-6 Panel.	X to X+2.5 Min.	None	

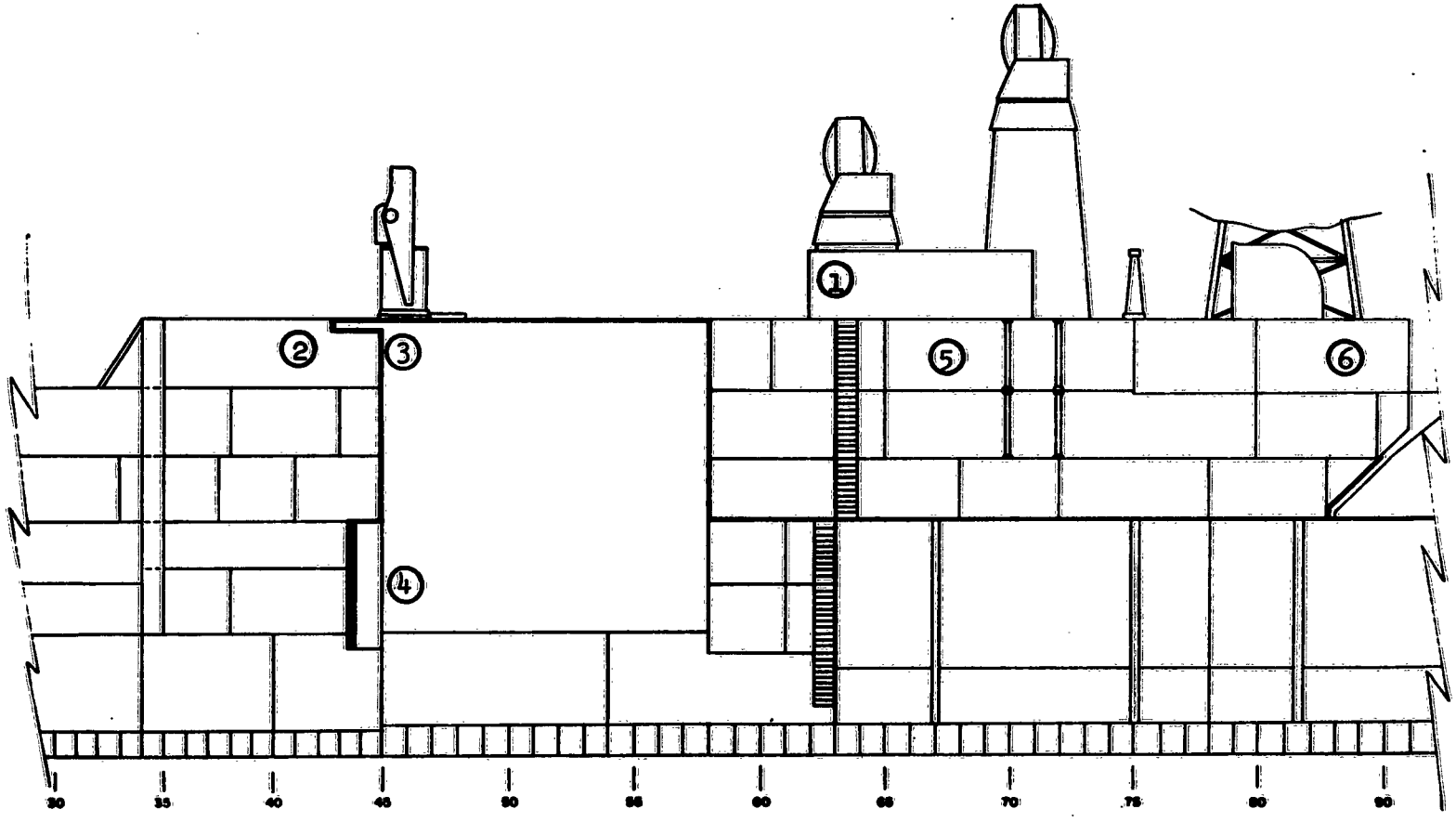
TABLE 15 (Continued)

Round No.	Type of Sample	No. of Samples	Sampling Area	Access or Sampling Time	Concentration	Remarks
3	Carbon Monoxide	2	Missile Checkout Area.	X to X+2.5 Min.	Less than 10 ppm	
		1	Motor Generator Room (Aft).	X+1.5 Min.	Less than 10 ppm	
		1	Officer Quarters (Aft).	X+1 Min.	Less than 10 ppm	
	*Lead	1	Missile Checkout Area.	X to X+5 Min.	.000 Mg/m^3	
	**Lead	1	Missile Checkout Area.	X to X+2.5 Min.	.000 Mg/m^3	
4	Carbon Monoxide	1	Engineer Room (Aft).	X to X+2.5 Min.	Less than 10 ppm	
		1	Crew Quarters (BC-63).	X to X+2.5 Min.	Less than 10 ppm	
	*Lead	1	Crew Quarters (BC-63).	X to X+5 Min.	.635 Mg/m^3	Lead in ambient air before firing .014 Mg/m^3.
		1	Engineer Room (Aft).	X to X+5 Min.	3.740 Mg/m^3	Lead in ambient air before firing .036 Mg/m^3.
	**Lead	1	Crew Quarters (BC-63).	X to X+2.5 Min.	.800 Mg/m^3	Lead in ambient air before firing .019 Mg/m^3.

*Impinger method of collecting lead.
**Filter method of collecting lead.

Abbreviations: X close of firing circuit
ppm parts per million
Mg/m^3 milligrams per cubic meter

APPENDIX B



MICROPHONE LOCATIONS

FIGURE 1

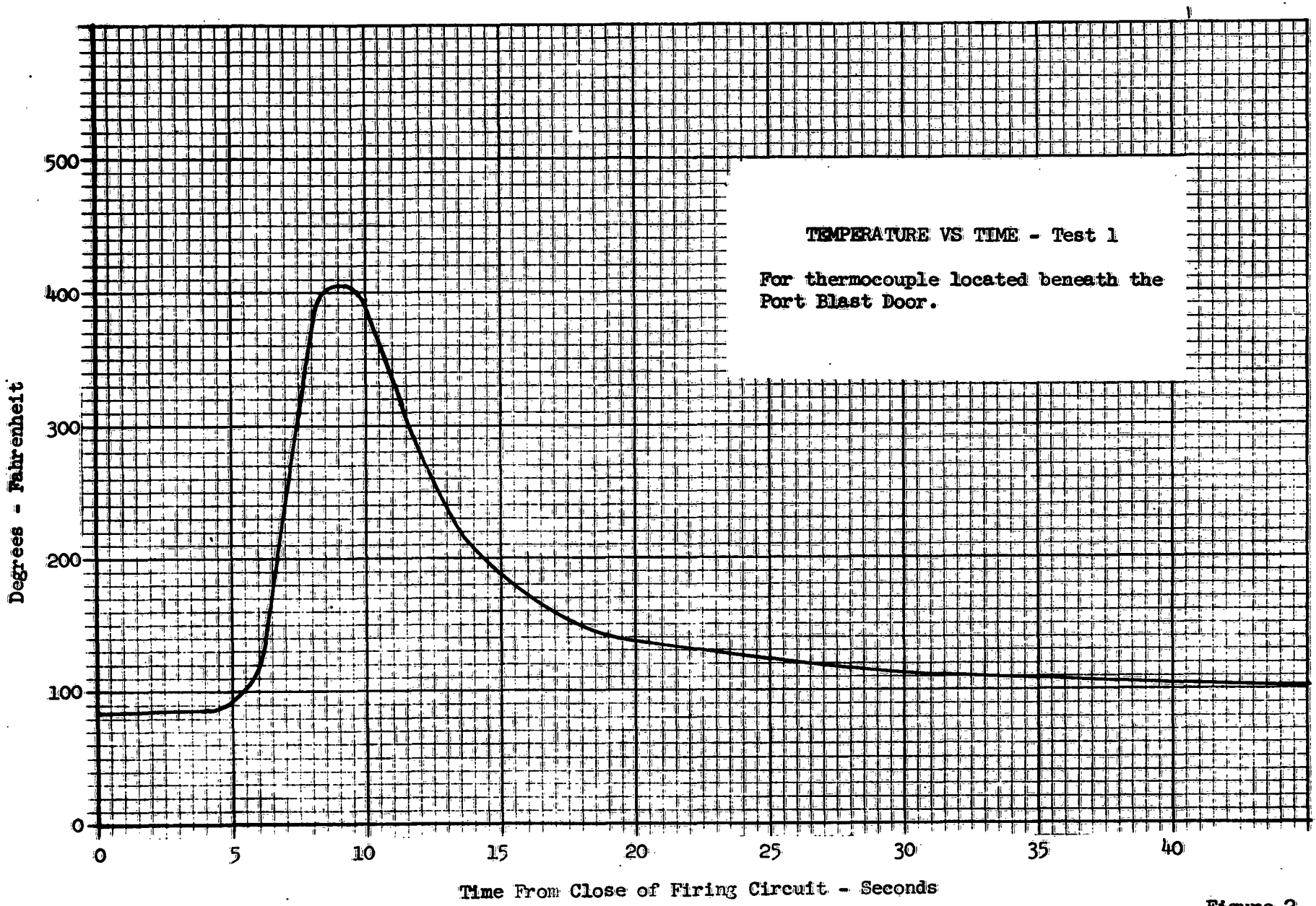
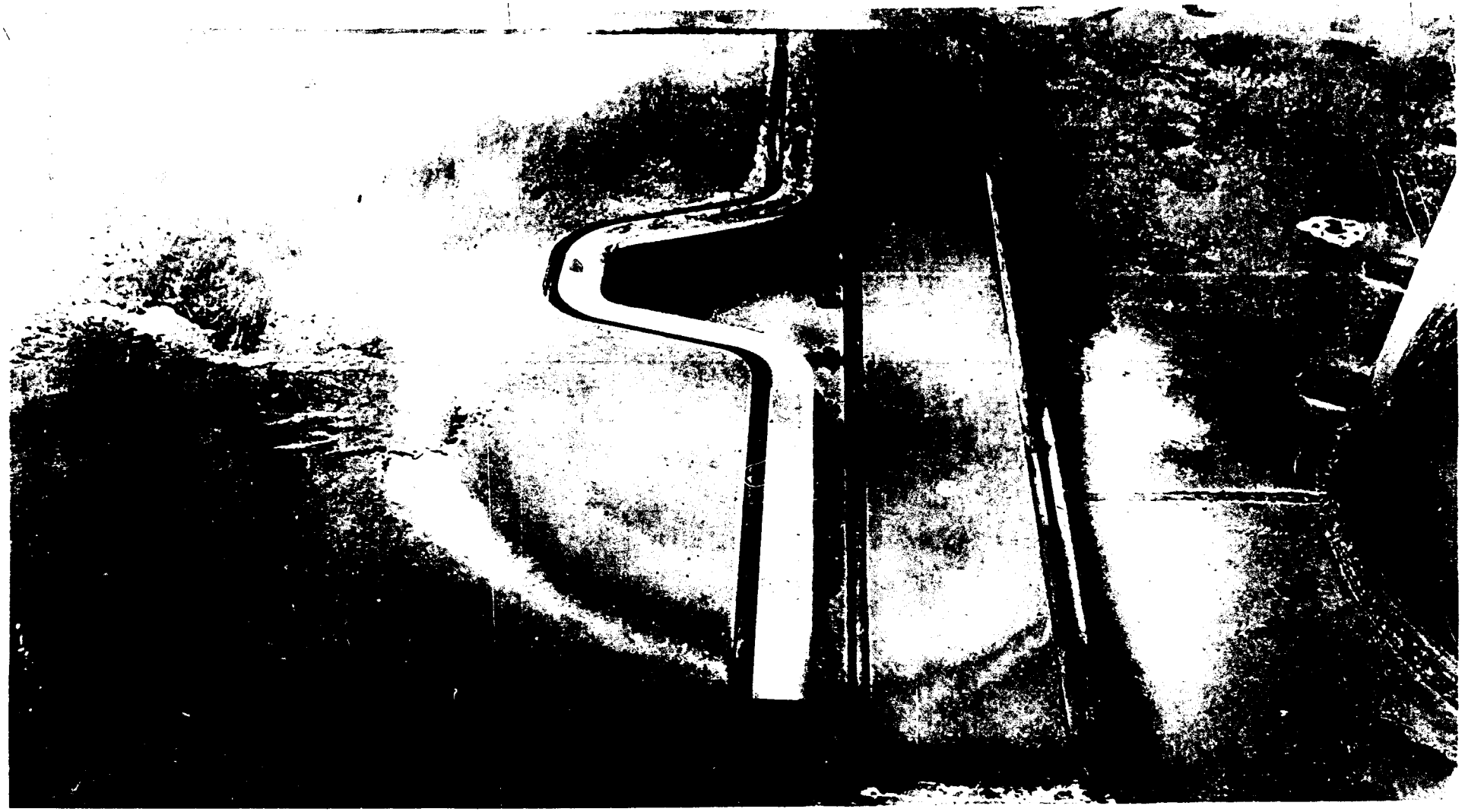

TEMPERATURE VS TIME - Test 1
For thermocouple located beneath the Port Blast Door.
Degrees - Fahrenheit
0
100
200
300
400
500
0
5
10
15
20
25
30
35
40
Time From Close of Firing Circuit - Seconds

Figure 2



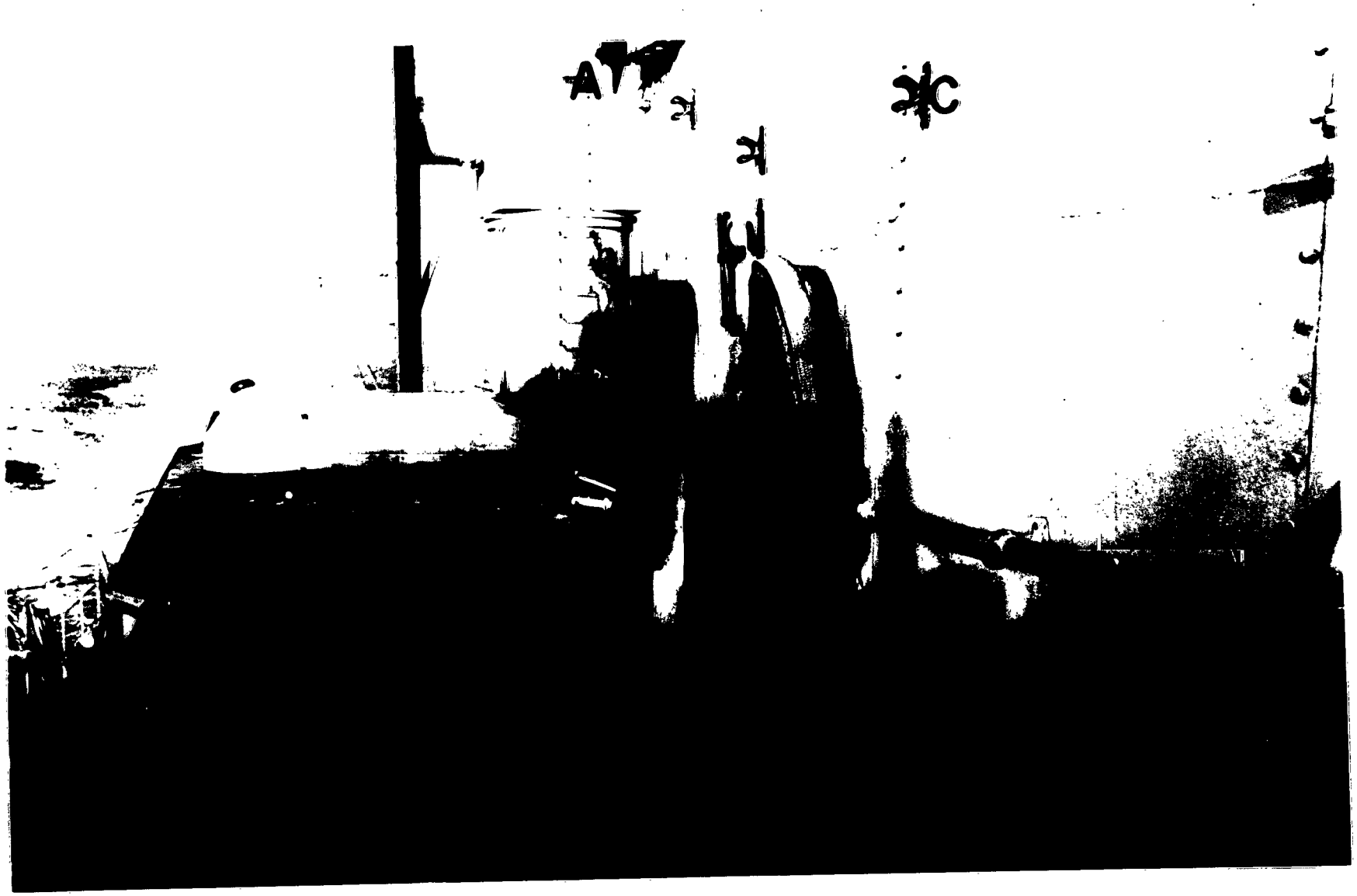
PHD-19787-10-62

Figure 3

View of Port Blast Door After Conduct of Test 1

1. Note the opening left in the door after the blast had subsided.
2. An excessive amount of gas and smoke entered the missile magazine through the door during Test 1.

5 October 1962

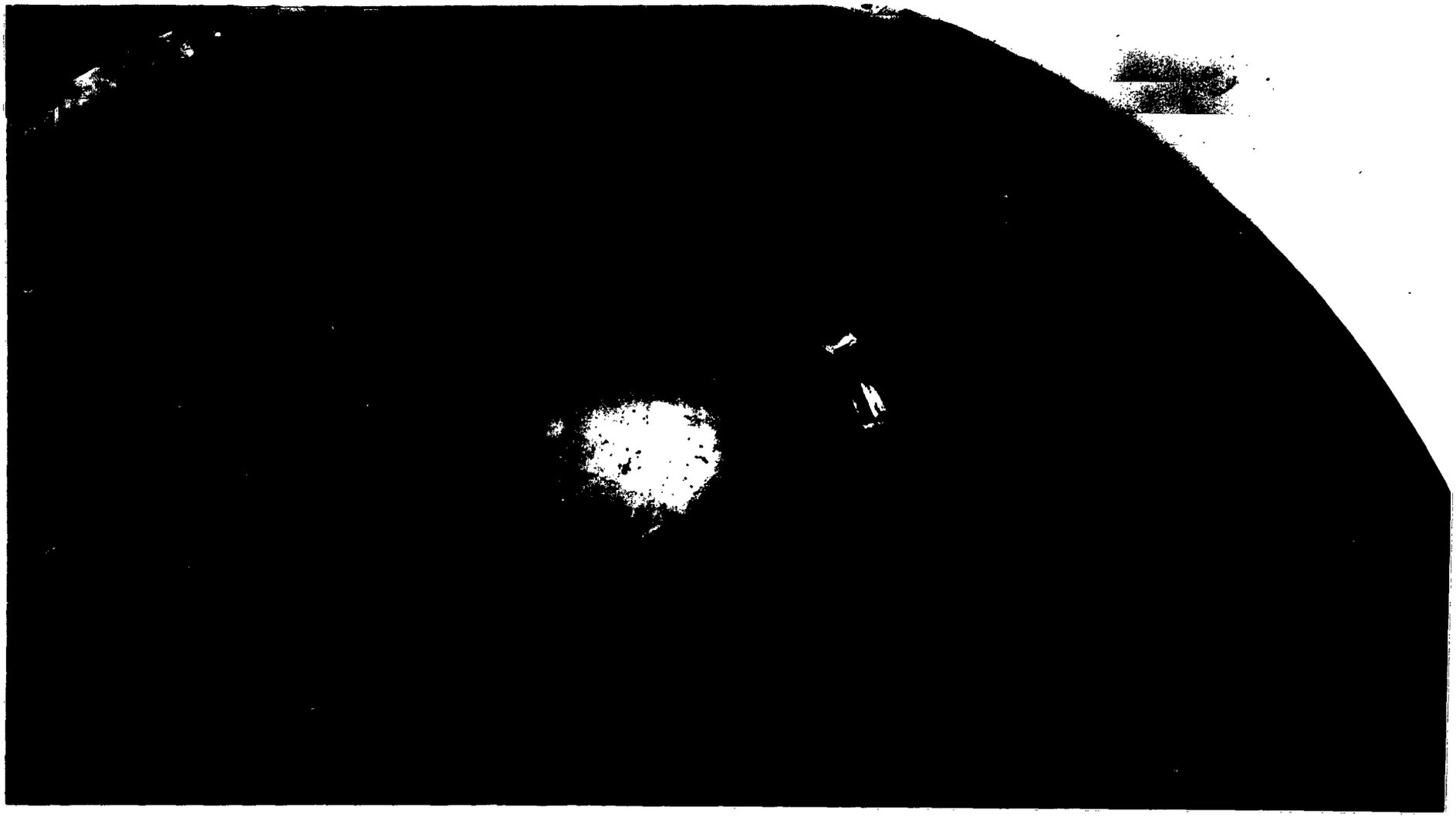


PHD-89785-10-62

5 October 1962

Figure 4
View of Starboard Side of II TUGA Deckhouse

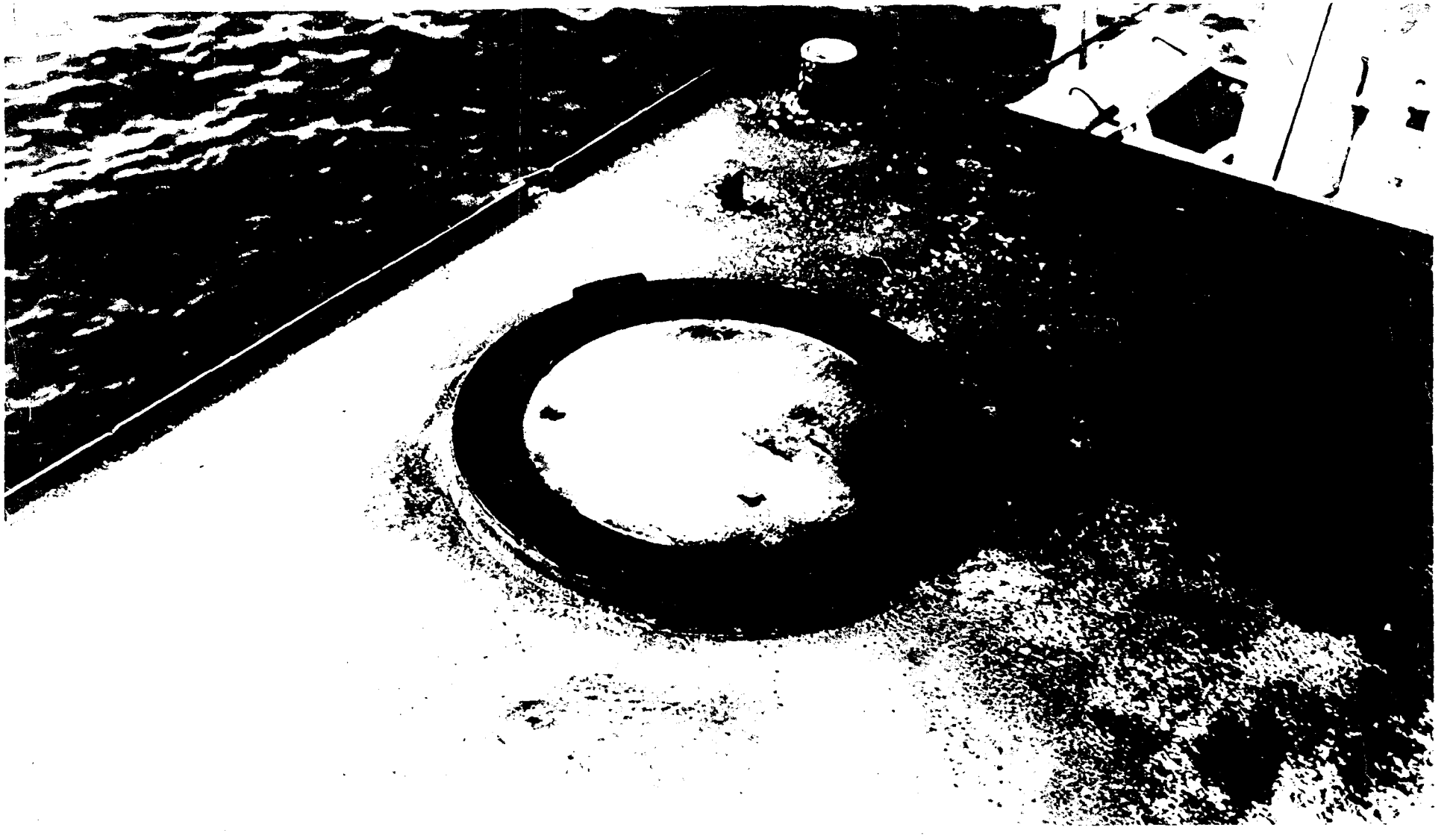
A. The lamp globe and lamp were broken by the blast.
B. The fire hoses were charred.
C. The fire fighting equipment was blown from the racks to the Coperta (main deck).



PHD-39784-10-62 Figure 5 5 October 1962

View of the Radome on the Main Antenna of the AN/SPG-55 Missile Director After Conduct of Test 4

1. Note the puncture in the radome.
2. The puncture, approximately 6 inches long and one inch wide, was caused by an unidentified object.



View of Ammunition Loading Gear
The cover of the Ammunition Loading Gear was blown away during Test 3.

APPENDIX C

DETAILS OF TEST EQUIPMENT AND PROCEDURES

1. Sound Pressure Measurements

Calibrated condenser microphones were used to measure the sound pressure levels, and the outputs from these microphones were recorded on magnetic tape and later analyzed with an audio-frequency spectrometer.

All the microphones were shock mounted with the diaphragm positioned in a horizontal plane. Before each test, the microphone systems were calibrated by applying a pure 400 cycle tone at 121 db with respect to the reference level 0.0002 dynes/cm^2.

2. Temperature Measurements

Iron-constantan thermocouples fabricated from No. 30 thermocouple wires and connected to a recording potentiometer were used to monitor the temperature in the areas indicated in Table 3. The recording equipment was capable of indicating a temperature change as small as one degree Fahrenheit. The recorder was operated over a period beginning 5 minutes before firing and ending 15 minutes after firing the booster.

3. Toxic Gas Sampling

Air samples were collected at the completion of each test using various gas sampling equipment to determine the presence and concentration of these substances. Before each test, air samples were collected to determine if lead or carbon monoxide was present from the previous test. The types of gas samplers employed were:

Gas	Sampler
Carbon Monoxide	Aminco[1] peristaltic pumps with Mine Safety Appliance Corporation (M-S-A) carbon monoxide indicating tubes.
	M-S-A Tester, Type By-47133.

[1]American Instrument Company

Gas	Sampler
Lead	M-S-A Lead-in-Air Detector.
	High velocity air samplers with Whatman No. 41 filter paper.
	Greenburg-Smith Impingers containing 1.99 Nitric Acid (HNO_3) aspirated by a Gast vacuum pump.
Oxide of Nitrogen	M-S-A Tester, Type Dy-83100.

APPENDIX D

DETAILED TEST CONDITIONS AND OBJECTIVES

Test No. 1:

Condition:	"A" rail loaded. Train 73°00' Elevation 65°00'.
Impingement Point Location:	Port Blast Door.
Objectives:	(1) To test the blast door for possible leakage of hot gases and flame. (2) To test for safe habitability of manned areas during missile firings.

Test No. 2:

Condition:	"A" rail loaded. Train 115°00' Elevation 43°20'.
Impingement Point Location:	Dud Jettisoning System (Portside).
Objectives:	(1) To test blast effects on the Dud Jettisoning System equipment. (2) To test for safe habitability of manned areas during missile firings.

Test No. 3:

Condition:	"A" rail loaded. Train 335°00' Elevation 13°00'.
Impingement Point Location:	II TUGA Deck (02 Level) Frame 34, Starboard Side.
Objectives:	(1) To determine the effects of blast on the missile strikedown equipment located on II TUGA deck at Frame 34, starboard side.

(2) To determine the effects of blast spillover on equipment mounted on the side of the loading area deckhouse.

(3) To test for safe habitability of manned areas during missile firings.

Test No. 4:

Condition: "B" rail loaded. Train 198°00' Elevation 6°35'.

Impingement Point Location: Starboard edge of II TUGA (02 Level) Deckhouse at Frame 62.

Objectives: (1) To determine blast effects on the intake and exhaust vents located at Frames 69-71, starboard side.

(2) To determine the effects of blast spillover on equipment mounted on the side of the deckhouse and on the Coperta (main deck).

(3) To determine safe habitability of the II TUGA deckhouse for personnel who will man the Safety Observer's Station and the Dud Ejector Control Panel located in the II TUGA deckhouse.

(4) To test II TUGA deckhouse checkout door for gas and flame tightness.

APPENDIX E

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BIBLIOGRAPHIC INFORMATION

DESCRIPTOR	CODE	DESCRIPTOR	CODE
SOURCE Naval Weapons Laboratory	NPGA	SECURITY CLASSIFICATION AND CODE COUNT UNCLASSIFIED	U030
REPORT NUMBER 1841	1841	CIRCULATION LIMITATION	
REPORT DATE 25 January 1963	0163	CIRCULATION LIMITATION OR BIBLIOGRAPHIC	
		BIBLIOGRAPHIC *(Suppl., Vol., etc.)*	

SUBJECT ANALYSIS OF REPORT

DESCRIPTOR	CODE	DESCRIPTOR	CODE	DESCRIPTOR	CODE
Terrier (Missile)	TERR	Italy	ITAL	Structures	STRC
Guided	GUIE	Cruiser (Ship)	CRUE	Firing	FIRI
Missiles	MISL	Launching	LAUC	Vehicles	VEHC
Surface-to-air	SHIO	Systems	SYST		
Surface-to-air	GRON	Tests	TEST		
Boosters	BOOS	Toxicity	TOXI		
Mark	MARK	Poison	POIS		
12	0012	Gases	GASE		
Ships	SHIP	Temperatures	TEMP		
Blast	BLAS	Measurements	MEAU		
Effects	EFFE	Equipment	EQUI		
Personnel	PERS	C	CAAA		
Safety	SAFE	551	0551		
Garibaldi	GARS	Hazards	HAZA		

Naval Weapons Laboratory, Dahlgren, Virginia
(NWL Report No. 1841)
TERRIER STRUCTURAL FIRING TEST ABOARD THE ITALIAN CRUISER GIUSEPPE GARIBALDI (C-551), by P. P. Wiggins and others. 25 Jan 1963. 10 p., 6 figs., 15 tables.
UNCLASSIFIED

4 TERRIER Mk 12 Mod 0 boosters with concrete slugs were fired aboard the Italian cruiser GIUSEPPE GARIBALDI (C-551) to investigate the adequacy of the protection for the TERRIER launching system personnel against blast effects and to determine the effects of the booster blast on the ship's structure. Results indicated excessive smoke and gas leakage through the Port Blast Door, gas leakage through the ventilation intake system (II TUGA), and minor structural damage to equipment mounted on the side of the II TUGA deckhouse.

1. Guided missile boosters - Mk 12
2. Personnel - Safety measures
3. Ships - Blast effects
4. Ships - Weapon systems
I. TERRIER
II. GIUSEPPE GARIBALDI
III. Wiggins, P. P.
IV. Dodson, T. I.
V. Lamonica, J. A.

Task: GTE-MAP-001/210-8/ W015B0-006

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